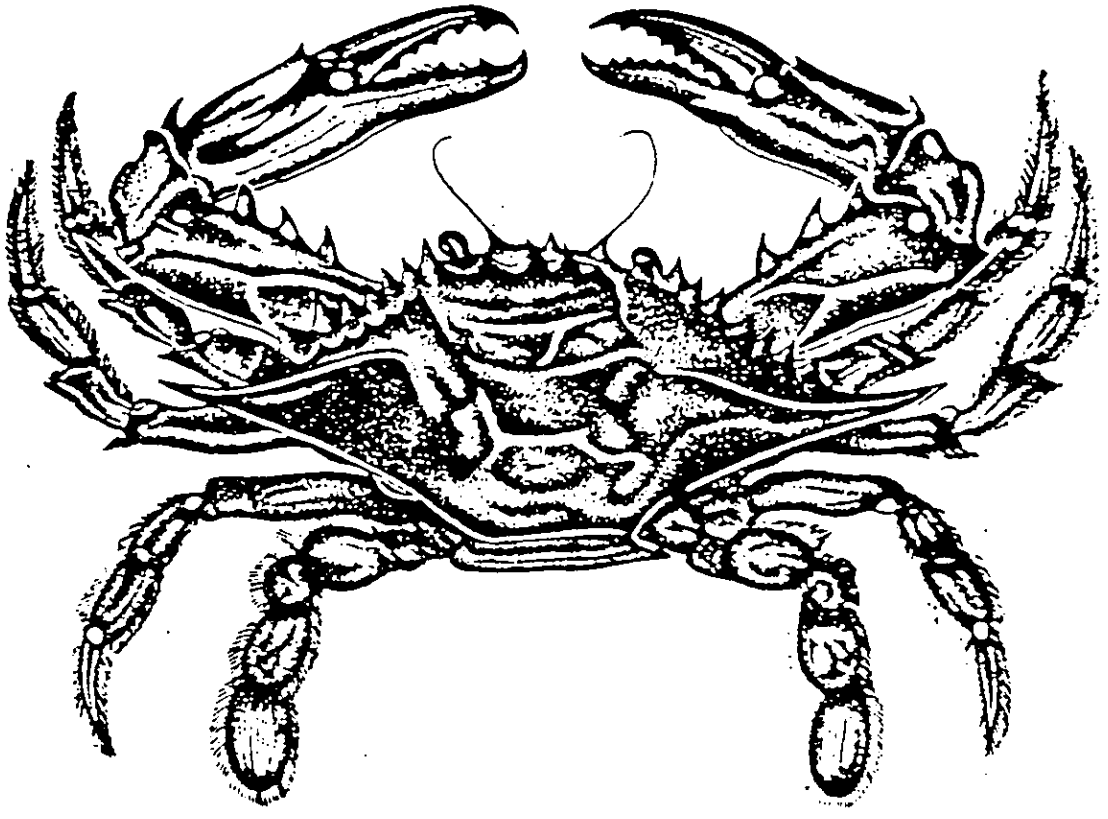
A MANAGEMENT PROFILE OF LOUISIANA

BLUE CRAB, Callinectes sapidus



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LOUISIANA DEPARTMENT OF WILDLIFE AND FISHERIES

BATON ROUGE, LOUISIANA

A MANAGEMENT PROFILE OF BLUE CRAB IN LOUISIANA

by

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Fishery Management Plan Series
Number 8, Part 3

1996

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EXECUTIVE SUMMARY

Standards for management of marine fishery resources extracted from are itemized. State and federal jurisdictional entities and their management authority are summarized. State of Louisiana Legislative statutes (Title 56) and Department of Wildlife of Fisheries regulations (Title 76) relevant to the blue crab (Callinectes sapidus) fishery are summarized and grouped under nine categories: gear, possession and size limits, time restrictions, area restrictions, other restrictions, miscellaneous, licensing requirements, reporting requirements, and penalties and compliance. Regulations from other states bordering the Gulf of Mexico are compiled. Problems and data needs in the fishery are identified and discussed: habitat, sublegal crabs, overcapitalization, user group conflicts, trap and crab theft, ghost fishing, availability of premolt crabs and bait, and definition of crab. Habitat is the most critical issue concerning long-term viability of the blue crab resource while management measures that reduce catch and harvest of sublegal crabs should be addressed immediately. Management recommendations or options are listed for each issue. Research topics to address problems or data needs are listed.

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1.0 INTRODUCTION

The blue crab (Callinectes sapidus) supports one of the largest commercial fisheries in the coastal waters of Louisiana. The blue crab fishery is the largest crab fishery in the United States. Louisiana has accounted for more than one-third of the total Gulf blue crab harvest since 1968 and more than 50% since 1983. In addition, the recreational fishery for blue crabs is popular and expanding. Blue crabs also comprise a crucial component in the estuarine food web and influences benthic communities through predation.

A fishery management plan provides the mechanism for an orderly, step-by-step process by which all available data and management regulations are reviewed, which in turn forms the basis for management recommendations and actions to address issues related to the fishery. A fishery management plan should not be considered permanent but rather as a dynamic, ongoing document that may be revised as management needs dictate. The fishery management plan consists of three seperate documents. The first report, "A biological and fisheries profile of the blue crab" by Guillory et al. (1995), serves as the source document. The second, "A stock assessment of blue crab in Louisiana" will assess the status of the stock. This document, the third in a three-part series, will compile regulations and jurisdiction, identify problems and data needs for the fishery, and present management options and research needs. Fishery management plans or profiles have been prepared for the Chesapeake Bay (Speir et al., 1995), South Carolina (Rhodes and Bishop, 1979), Gulf of Mexico (Steele and Perry, 1990) and Texas (Cody et al., 1992) blue crab fisheries.

2.0 STANDARDS

Standards for the harvesting, conservation, and management of marine fisheries resource are itemized in the "Saltwater Fishery Conservation and Management Act [Revised Statutes (R.S.) 56:638]". These standards, which essentially emulate those of the federal Magnuson Fishery Conservation Act, are summarized below. Although these standards are in reference to finfish, they are considered suitable for decapod crustaceans.

1. Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, optimum yield while maintaining healthy, plentiful stocks.

2. Conservation and management measures shall be based upon the best scientific, economic, biological, anthropological, and sociological information available.

3. To the extent practicable, an individual stock or unit of fish shall be managed as a unit throughout its range within the state's jurisdictional authority.

4. If it becomes necessary to allocate or assign fishing privileges among various fishermen, such allocations to the extent practicable shall be: a) fair and equitable to all such fishermen; b) reasonably calculated to promote conservation; c) carried out in such a manner that no particular individual, corporation, or other legal entity acquires an excessive share of such privileges; and, d) in the best interest of the citizens of Louisiana.

5. Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

6. Conservation and management measures may take into account and allow for variations among, and contingencies in, fisheries resources and catches.

3.0 JURISDICTION

Management agencies regulating Gulf of Mexico fisheries include the Gulf of Mexico Fishery Management Council, the National Marine Fisheries Service, and respective state agencies. Without a federal management plan, regulation of the blue crab fisheries remains at the discretion of the coastal states within the range of the species; however, various Federal agencies may directly or indirectly influence the blue crab resource or fishery.

The following is a summary of state and federal jurisdictional entities and their management authority.

3.1 Louisiana

Although not involved in marine fisheries management, several state or local agencies are involved in habitat protection or water quality monitoring in the coastal zone. The Department of Natural Resources (DNR) is charged with coastal zone management and overseeing permit activities. In addition, several coastal parishes have developed their own coastal zone management programs. In the 1989 Second Extraordinary Session, Senate Bill Number 26 created an office of Coastal Restoration and Management in DNR, a Wetland Conservation and Restoration Authority in the Governor's Office, and a Wetlands Conservation and Restoration Fund. The Louisiana Department of Environmental Quality has the responsibility of setting and monitoring pollution standards for all waters of the state, including the Gulf of Mexico.

The Louisiana Department of Wildlife and Fisheries (LDWF) is one of 21 major administrative units of the Louisiana government. A seven-member board, the Louisiana Wildlife and Fisheries Commission, is appointed by the Governor. Six of the members serve overlapping terms of six years, and one member serves a term concurrent with the Governor. The Commission is a policy-making and budgetary control board with no administrative functions. The Secretary of the LDWF is "the executive head and chief administrative officer of the Department" and is responsible for the administration, control and operation of the functions, programs, and affairs of the Department. The Secretary is appointed by the Governor with consent of the Senate.

Within the administrative system, an Assistant Secretary is in charge of the Office of Fisheries. In this office, the Marine Fisheries Division, headed by the Division Administrator, performs "the functions of the Department relating to administration and operation of programs, including research relating to oysters, waterbottoms and seafoods including, but not limited to, the regulation of oyster, shrimp, and marine fishing industries." The Enforcement Division, in the Office of the Secretary, is responsible for enforcing all marine fishery statutes and regulations.

Responsibility for blue crab management in Louisiana is divided among the Legislature, the Wildlife and Fisheries Commission, and the Secretary of the LDWF. The Legislature

through statutes has provided a regulatory framework for the blue crab fishery and industry. Individual responsibilities that may pertain to the blue crab fishery are delegated to the Commission and the Secretary as presented below.

The Commission: a) shall have sole authority to establish management programs and policies (R.S. 56:2); b) has full power and control over all fish, may promulgate regulations to set seasons, times, places, size limits, quotas, daily take, and possession limits for all fish, with any present statutory rule or regulation being superseded, and may impose a fee for nonresident recreational fishing licenses that supersedes fees set by legislative statute (R.S. 56:6); c) may prohibit the taking of any species of fish in any part of the state for not more than a three-year period if it is in the best interests of the state (R.S. 56:22); d) has exclusive control of fish having a game or commercial value (R.S. 56:313); e) may set aside sanctuaries for the protection and propagation of fish and may restrict fishing (R.S. 56:315); f) has the authority to set size limits for all game and commercial fish for which no limits have been set by law (R.S. 56:326.1); and, g) shall have the sole authority to regulate and control fishing within various watershed and recreation districts (R.S. 38:2501).

The Secretary may: a) adopt rules to govern the procedures of advisory committees created in or for the Department (R.S. 56:6.2); b) grant written permits to other persons to take fish of any kind in any manner or place for the purpose of cultivation (R.S. 56:17); c) declare a closed season, or restrict fishing in the closed season, for any species of fish, upon receiving evidence that fish in any waters of the state have been depleted through overfishing, or that fishing is detrimental to the interests of the state (R.S. 56:317); d) issue permits to take fish for scientific or educational purposes or for propagation or for distribution (R.S. 56:318); e) issue permits to take fish to develop new fisheries designed to harvest underutilized species and to develop new gear and equipment to harvest fish (R.S. 56:571); f) set seasons, regulate the type of gear used, and set possession limits for estuarine fish where it is clearly demonstrated that intense competition exists or if pollution levels exceed accepted standards or if biological studies indicate the need [R.S. 56:327(E)]; and, g) issue mariculture permits and exempt permitees from statutory limitations on harvesting and propagation of fish (R.S. 56:579.1).

3.2 Other States

The basic characteristics of state agencies along the Gulf of Mexico that are involved in fishery management are summarized in Table 3.1.

3.3 Federal

Information about Federal management institutions were extracted from the Gulf States Marine Fisheries Commission (GSMFC) regional blue crab fisheries management plan (Steele and Perry, 1990).

Regional Fishery Management Councils

With the passage of the Magnuson Fishery Conservation Management Act (MFCMA), the Federal government assumed responsibility for fishery management within the Exclusive Economic Zone (EEZ), a zone contiguous to the territorial sea and whose inner (landward) limit is the boundary of each coastal state. The outer (seaward) boundary of the EEZ is a line 200 miles from the (inner) baseline of the territorial sea. Management of the EEZ is to be based on plans developed by fishery management councils. Each Council prepares plans with respect to each fishery requiring management within its geographical area of authority and amends such plans as may be implemented as Federal regulation.

Among the guidelines under which the councils must operate are standards which state that to the extent practicable, an individual stock of fish shall be managed as a unit through its range and that management shall, where practicable, promote efficiency and shall minimize costs and avoid unnecessary duplication (MFCMA Section 301a). Management should protect the stock from overfishing while achieving on a continuing basis the optimum yield from the fishery.

National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration (NOAA)

The Secretary of Commerce, acting through NMFS, has the ultimate authority to approve or disapprove all fishery management plans prepared by regional fishery management councils. Where a council fails to develop a plan, or to correct an unacceptable plan, the Secretary may do so. The NMFS also collects data and statistics on fisheries and fishermen to aid fishery management and conducts management authorized by international treaties. The NMFS has the authority to enforce the MFCMA and Lacey Act and is the Federal trustee for living and nonliving natural resources in coastal and marine areas under United States jurisdiction pursuant to Section 107(f) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA or "Superfund"), Section 311(f)(5) of the Clean Water Act (CWA), Executive Order 12580 of January 23, 1987, and Subpart G of the National Oil and Hazardous Substances Pollution Contingency Plan.

Office of Coastal Zone Management (OCZM) NOAA

The OCZM asserts authority through the National Marine Sanctuaries pursuant to Title III of the Marine Protection, Research and Sanctuaries Act (MPRSA). By setting standards for approving and funding state coastal zone management programs, OCZM may further influence fishery management.

National Park Service (NPS), Department of the Interior (DOI)

The NPS retains the authority to manage shellfish primarily through the establishment of coastal and nearshore national parks and national monuments.

Fish and Wildlife Service (FWS), DOI

The FWS may affect shellfish management because of the Endangered Species Act and the Fish and Wildlife Coordination Act. Under the Fish and Wildlife Coordination Act, the FWS reviews and comments on proposals for work and activities in or affecting navigable waters that are sanctioned, permitted, assisted or conducted by Federal agencies. The review focuses mainly on potential damage to fish and wildlife and their habitat.

Environmental Protection Agency (EPA)

The EPA may provide protection to shellfish communities through the granting of National Pollutant Discharge Elimination System (NPDES) permits for the discharge of pollutants into ocean waters and the conditioning of those permits to protect valuable resources.

Corps of Engineers (COE), Department of the Army

The COE jurisdiction over the disposal of dredged material, pursuant to both the Clean Water Act and the MPRSA, could be exercised to protect fishery resources.

3.4 Other Management Institutions

The GSMFC is charged with responsibility for developing regional management plans for the fisheries that move between or are broadly distributed between the territorial waters and areas seaward thereof and for recommending suitable policies and strategies to each member state. A blue crab management plan has been recently completed by the Crab Subcommittee of the GSMFC (Steele and Perry, 1990).

Table 3.1. State management institutions for Gulf coastal states.

	Administrative body and its responsibilities	Administrative policy-making and rule-making body	Legislative involvement in management regulations
FLORIDA	DEPARTMENT OF ENVIRONMENTAL QUALITY . administers management programs . enforcement . conducts research . makes recommendations to legislature and Marine Fisheries Commission	FLORIDA MARINE FISHERIES COMMISSION . creates rules which must be approved by the governor and cabinet. . seven member commission	. can override any rule of the commission . responsible for licensing, management of fishing in man-made canals and limited entry.
ALABAMA	DEPARTMENT OF CONSERVATION AND NATURAL RESOURCES . administers management programs . enforcement . conducts research	. Commission of department has authority to establish management regulation. . Conservation Advisory Board is a thirteen member board and advises the commissioner . has authority to amend and promulgate regulations	. authority for detailed management regulations delegated to commissioner . statutes concerned primarily with licensing.
MISSISSIPPI	DEPARTMENT OF WILDLIFE FISHERIES AND PARKS . administers management programs . enforcement . conducts research	COMMISSION ON WILDLIFE, FISHERIES AND PARKS . five-member board . establishes ordinances on recommendation of deputy director (BMR).	. authority for detailed management regulations delegated to commission . statutes concern licenses and taxes with some specific restrictions on oysters.
TEXAS	PARKS AND WILDLIFE DEPARTMENT . administers management programs . enforcement . conducts research . makes recommendation to TPWC.	PARKS AND WILDLIFE COMMISSION . nine-member body establishes regulations based on majority vote of quorum (five members constitute a quorum)	. licensing requirements are set by legislation.

4.0 RULES AND REGULATIONS

4.1 Louisiana - State

The blue crab fishery and industry are governed by both State of Louisiana legislative statutes (Title 56) and rules promulgated by the Wildlife and Fisheries Commission (Title 76). Regulations relegated to other state or federal agencies concerning water quality discharges, solid wastes, public health, safety, etc. are not included. The purpose of this compilation is to provide a background from which recommendations are based.

Specific regulations are grouped by category in the following paragraphs. This summary should be used as a digest only, not as a valid compilation for legal purposes, because the exact language has not been retained. Furthermore, these regulations are subject to change, and are only valid at the time of publication.

4.1.1 Gear

R.S. 56:8. "Crab dropnet" means any device constructed with vegetable, synthetic or metal fibers and without flues or throat, attached to a wire frame that forms a net basket and is used for the purpose of taking crabs. This device must be operated solely by hand and fished in a stationary, passive manner.

"Crab trap" means a cube-shaped device with entrance funnels and either a bait box or materials providing cover or shelter for peeler crabs, which is used for the sole purpose of taking crabs. This device must be fished in a stationary, passive manner.

"Trotline" means any set line with hoop drops tied at various intervals.

"Work box" means a standard crab crate as used by a commercial crab fishermen aboard the vessel to sort or cull undersized crabs from the harvest in order to obtain a legal catch.

R.S. 56:320(B)(3). Crabs may be taken with any legal crab trap, crab dropnet, trawl, trotline, handline, bushline, dip net, or cast net. Dredges cannot be used for the intentional taking of crabs.

R.S. 56:323. For the purpose of taking minnows, shrimp, and other baits, seines of one-fourth inch mesh or less and measuring 30 feet or less in length, cast nets, dip nets, minnow traps, or other devices approved by the Commission may be utilized. Seines 100 feet or less may be used for taking bait only in saltwater areas.

R.S. 56:332(A). Crabs of legal size may be taken using any gear identified in R.S. 56:320(B)(3); however, harvest of crabs by trawls in inside waters is permitted only during the open season for shrimp and with a legal commercial mesh size.

R.S. 56:551. In private artificial earthen reservoirs, except in Orleans Parish, crabs of any species may be harvested with seines or tackle selected by the owner.

R.S. 56:640.3. The Department shall recommend the elimination of a presently legal method to harvest fish only if the species affected by that harvesting method will be damaged without the elimination of the method.

Commission Action 76:345/R.S. 56:332(D). Each crab trap shall be marked with a 1/2 inch stainless steel self-locking tag containing the commercial fishermen's license number attached to the center of the trap ceiling.

4.1.2 Possession and Size Limits

R.S. 56:326(A). Blue crabs of legal size may be taken in unlimited quantities, provided there is compliance with all other requirements of the law.

Any blue crab less than the minimum prescribed commercial size must be returned immediately to the waters from which taken without avoidable injury. Blue crabs less than the commercial legal size may be taken from privately owned ponds, impoundments, or waters and sold to other persons for purposes of stocking private waters, ponds, or impoundments.

The size limit on hardshell commercial crabs is five inches in carapace width, except when held for later processing as soft crabs or sold to a processor for making of crabs.

Premolt crabs less than five inches in width held by a commercial fishermen for later processing as softshell crabs must be identifiable as premolt crabs and must be held in a separate container marked "peelers" or "busters." Pre-molt "buster" or "peeler" stage crabs must be no further from molting than having a white line on the back paddle fin.

R.S. 56:326(B). If more that 10 percent of crabs in a fifty crab random sample are less than the minimum commercial size limit, the entire number of crabs in that crate or group of crabs equivalent to one crate is in violation.

Crabs in a work box are not subject to the minimum commercial size limits for hardshell crabs while held aboard the vessel. Each fisherman may have one work box, if not using a grader, or two work boxes under the grader, if using a grader.

R.S. 56:409(A). Prohibits the harvesting of any fish for commercial purposes which results in the excessive killing, or wasting, of such fish.

Commission Action. Twelve dozen crabs per boat or vehicle per day are allowed in Rockfeller Wildlife Refuge (76:309), Marsh Island Wildlife Refuge (76:310), Pointe-au-Chien Wildlife Management Area (76:312), and Salvador Wildlife Management Area (76:313).

4.1.3 Time Restrictions

R.S. 56:332(C). The baiting, tending, checking, or removing of crab traps, the contents of crab traps or their lines, buoys, or markers is prohibited in public waters from one-half hour after sunset until one-half hour before sunrise.

R.S. 56:332(E). Crab traps which are no longer serviceable or in use must be removed from the water.

R.S. 56:410.3. Requires the Commission to set times and days for the recreational and commercial taking of crabs during the inshore shrimp season in Sabine Lake.

Commission Action. Recreational crabbing allowed from official sunrise to sunset in Rockefeller Refuge (76:309) and Marsh Island Wildlife Refuge (76:310) and from 1 1/2 hours before sunrise to 30 minutes after official sunset on Pointe-au-Chien and Salvador Wildlife Management Areas. Portions of Rockefeller Refuge is further restricted from March 1 to December 1.

4.1.4 Area Restrictions

R.S. 56:332(G). Crab traps cannot be set in navigable channels or entrances to streams.

R.S. 56:332(I). The taking of crabs with legal crab traps, crab pots, nets, and lines shall be permitted in the Lake Catherine and Lake Pontchartrain Sanctuary.

R.S. 56:332(J). Metal tackle or metal crab traps shall not be used in any of the public waters north of the Intracoastal Canal in the Calcasieu River or in any body of water comprising the Calcasieu River System north of the Intracoastal Canal, or in the waters of Vermilion Bay from Cypremort Point one mile offshore to Blue Point.

R.S. 56:405(A). The use of seine, nets, webbing or traps of any and all types is prohibited in the Tchefuncte River.

R.S. 56:410.3. The Commission shall designate areas in Sabine Lake where crab traps or other legal crab gear may be used.

Commission Action. Commercial gear (trawl, trotline, traps) or commercial fishing is not allowed from the Grand Isle shoreline out to the one fathom curve (76:305) or on the following wildlife management areas or refuges: Rockefeller Wildlife Refuge (76:309), Marsh Island Wildlife Refuge (76:310), Pointe-au-Chien Wildlife Management Area with the exception of Wonder Lake and Cut Off Canal (76:312), and Salvador Wildlife Management Area (76:313).

4.1.5 Other Restrictions

R.S. 56:331(A). No person may take diamondback terrapins by traps of any kind.

R.S. 56:332(B). No person can keep or sell adult female crabs in the berry, or egg, stage. All crabs in the berry stage taken by any means must be returned immediately to the waters. However, a legally licensed commercial crab fishermen may have in his workbox an incidental take of crabs in the berry stage in an amount equal to not more than two percent of the total number of crabs in his possession.

R.S. 56:332(E). No person may intentionally damage or destroy crab traps, floats or lines, or remove the contents thereof, other than the licensee or his agent.

R.S. 56:326(F). Commercial fishermen must tag or mark any crabs sold with their commercial fisherman's license number, name, and date harvested.

R.S. 56:648. No person shall disturb any fisherman who is engaged in the lawful taking of fish.

4.1.6 Miscellaneous

R.S. 56:8. The following definitions appear in this section which are pertinent to regulations affecting the blue crab fishery.

"Bait species" means all species of fish and other aquatic life utilized for bait.

"Commercial fish" means all freshwater commercial fish and saltwater commercial fish found in the waters of the state.

"Fish" (noun) means all finfish, shellfish, crustacean, frogs, turtles, and other living aquatic resources which have a sport or other economic value.

"Fish" (verb) means to take or attempt to take fish by any method approved by the commission for recreational purposes or for commercial purposes.

"Shellfish" means an aquatic, invertebrate species having a shell. These species include, but are not limited to, oysters, clams, crayfish, shrimp, crabs, and other mollusks and crustaceans.

R.S. 56:579. Approved mariculture permittees may be granted exemptions, from the Department, relative to statutory limitations on species, harvest methods, seasons, size restrictions, hatchery propagation, etc.

4.1.7 Licensing Requirements

R.S. 302.3. In addition to the basic recreational fishing license, a recreational fishermen must purchase the appropriate gear license. Gear fees for residents are: $10 for up to 10 crab traps; for traps attached to a trotline, the fee is $1 per trap; $25 for a trawl not exceeding 16 ft. in length. The gear fee for nonresidents is double that of residents.

Any citizen of the state on active military duty shall not be required to purchase a recreational gear license.

R.S. 56:303. All commercial crab fishermen must possess a commercial fisherman's license in his name ($55 for residents, $200 for nonresidents).

R.S. 56:304. A vessel engaged in commercial crabbing or in possession of crabs for resale in saltwater areas must be licensed in the name of the vessel owner ($15 for residents and $60 for nonresidents).

R.S. 56:305. A commercial crab fisherman must possess an appropriate commercial gear license. Commercial license fees are as follows:

	resident	nonresident
crab trap	$25	$100
crab trap/trotline (per trap up to 25)	$ 1	$ 4
trotline/bushline	$25	$100

R.S. 56:305.6. From January 1, 1996 through December 31, 1998, no person shall be issued a commercial crab trap gear license unless that person possessed a valid commercial crab trap gear license for the year 1993, 1994, or 1995.

R.S. 56:306. A person buying, acquiring, or handling any crabs for resale must purchase a wholesale/retail dealer's license, which is valid for only one place of business.

Wholesale/retail dealer license fees are as follows:

	resident	nonresident
business	$105	$405
vehicles	$105	$405
restaurants/retail groceries	$ 30	---

R.S. 56:307. Operators and drivers of any commercial transport except common carriers (ie., person transporting for hire), carrying crabs shall have in their possession one of the following: a commercial fisherman's license, a wholesale/retail dealer's license or a transport license ($30).

R.S. 56:309. An operator of a soft shell crab shedding facility is required to obtain a soft shell crab shedder's license costing $100 for residents and $400 for nonresidents.

4.1.8 Reporting Requirements

R.S. 56:309.4. A soft shell crab shedder shall on or before the tenth of each month file a report to the Department detailing the quantity and prices of premolt or buster crabs acquired and soft shell crabs sold.

R.S. 56:345(A). Any wholesale or retail dealer buying crabs from anyone other than a licensed wholesale/retail dealer shall on or before the tenth of each month file a report to the Department detailing the volume and average price per pound purchased.

R.S. 56:345(B). Any commercial crab fisherman selling to anyone other than a resident wholesale/retail dealer shall on or before the tenth of each month send a report to the Department.

4.1.9 Penalties and Compliance

R.S. 56:326(F). If the wholesale or retail dealer can identity the commercial fisherman who harvested the undersized crabs, only the latter is subject to undersize crab violations.

The class of violation varies by legislative statute or Commission promulgation that applies to crabs. Penalties for each class of violation are provided below.

Class One (R.S. 56:31): First offense -- a civil penalty of $50; second offense -- a civil penalty of $100; third and subsequent offenses -- a civil penalty of $200.

Class Two (R.S. 56:32): First offense -- fine of $250-$350, or imprisonment of not more than 60 days, or both; second offense -- fine of $300-$550 and imprisonment of 30-60 days; third and subsequent offenses -- fine of $500-$700 imprisonment of 60-90 days, and forfeiture of anything seized in connection with the violation.

Class Three (R.S. 56:33): First offense -- fine of $250-$500, or imprisonment of not more than 90 days, or both; second offense -- fine of $500-$800, imprisonment of 60-90 days, and forfeiture of anything seized in connection with the violation; third and subsequent offenses -- fine of $700-$1000, imprisonment of 90-120 days, and forfeiture of anything seized in connection with the violation.

Class Four (R.S. 56:34): First offense -- fine of $400-$450 dollars, or imprisonment of not more than 120 days, or both; second offense -- fine of $750-$3000 and imprisonment of 90-180 days; third and subsequent offenses -- fine of $1000-$5000 and imprisonment of 180 days to two years.

In addition, violators: a) must forfeit any blue crabs in connection with the violation (R.S. 56:39); b) may have their license revocated (R.S. 56:38); c) have illegal or improperly tagged fishing gear confiscated (R.S. 56:314); and, d) be liable for civil penalties for the restitution of value (R.S. 56:40). The civil penalty for blue crabs is $0.41 per pound (76:313).

4.2 Louisiana - Federal Refuge Regulations

Special rules and regulations pertaining to Federal Refuges have been promulgated by the FWS.

Sabine National Wildlife Refuge. Recreational crabbing with rod and reel, pole, and line only permitted between one hour before sunrise to one hour after sunset from March 1 through October 15 on designated waterways and pools. Bank crabbing along Hwy. 27 is exempt from seasonal restrictions. Crabbing in the East Cove unit is permitted year-round except during the regular duck hunting season.

Lacassine National Wildlife Refuge. Recreational crabbing only permitted on the refuge between one hour before sunrise to one hour after sunset during the period March 1 through October 15. All commercial crabbing gear prohibited.

Delta National Wildlife Refuge. Recreational crabbing permitted in all refuge waters during daylight hours except during the waterfowl hunting season. The refuge is closed to all trot-lining.

4.3 Other States

The Gulf States of Florida, Alabama, Mississippi, and Texas have enacted rules and regulations pertaining to the blue crab fishery.

4.3.1 Florida

1. Legal gear: traps; dip or landing net; drop net; fold-up trap with a square base panel no larger than one foot square; hook and line gear; push scrape; trotline; and, as bycatch in shrimp trawls, roller frame trawls, and other gear.

2. Trap specifications: the throats or entrances must be located on a vertical surface; minimum mesh sizes of hard crab and peeler traps are 1 1/2 and 1 inch, respectively; maximum dimensions are 24 inches, by 24 inches, by 24 inches, or a volume of 8 cubic feet; each trap shall have three 2 3/8 inch escape rings, with one located on a vertical outer surface of each chamber.

3. A degradable panel is required on every crab trap. Acceptable options include: a) a jute lid tie-down strap; b) a corrodible tie-down hook composed of non-coated steel wire measuring 24 gauge or less; c) a 6-inch by 3-inch vertical opening which is obstructed by a single length

of jute twine; and, d) a 6-inch by 3-inch vertical opening obstructed with an untreated pine slat no thicker than 3/8 inch.

4. Buoy/line: A buoy or a time release buoy shall be attached to each trap or at each end of a weighted trot line. Each buoy shall: a) be constructed of styrofoam, cork, molded polyvinyl chloride, or molded polystyrene; b) be of sufficient strength and buoyancy to float; c) of such color, hue and brilliancy to be easily distinguished, seen and located; and, d) a minimum of six inches in diameter. No more than five feet of a buoy line shall float on the surface of the water.

4. Trap identification: each buoy must have the license number of the commercial fishermen or a letter "R" for a recreational fishermen in numbers or letter 2-inches high; and, the color and trap number shall be permanently and conspicuously displayed on a commercial fisherman's boat in the manner prescribed by the Division of Law Enforcement so as to be readily identifiable from the air and water. A recreational fisherman must have his name and address permanently affixed to the trap. Each buoy shall have the letter "R" (2-inches high).

5. Minimum commercial size = 5 inches carapace width (CW), with a 5% tolerance. Exempt -- peeler crabs kept in a separate container; and, bait caught by a fishermen with a special activity live bait license.

6. Blue crabs may be harvested as incidental bycatch subject to the following restrictions: a) shrimp trawls -- up to 200 pounds per vessel per trip; b) roller frame trawls -- up to 10 gallons of undersize crabs may be sold, bartered, or exchanged solely for their use as live bait; and, c) other gear -- up to 10 gallons may be harvested if no other applicable provision of the law is violated.

7. Recreational fishermen may not harvest or possess more than 10 gallons of whole blue crabs.

8. Possession of ovigerous females prohibited, and must be returned immediately to the water. Removal of eggs from crabs is prohibited.

9. Recreational fishermen may not use more than five traps.

10. Traps may be worked during daylight hours (from one hour before sunrise until one hour after sunrise) only.

11. No person may willfully handle any traps, lines or buoys belonging to another without permission of the license holder.

12. Licenses: commercial fishermen - saltwater products license, blue crab permit, and restricted species endorsement; other - wholesale and retail dealer licenses; recreational fishermen - crabbing license for traps.

13. Reporting: monthly summaries (volume and value of crabs with related trips information)

required from dealers/processors.

4.3.2 Alabama

1. Trap specifications: maximum volume shall not exceed 27 cubic feet.

2. Buoy/line: traps must be marked with at least one buoy no smaller than six inches in diameter, one half of which must be white; buoy line must be nonfloating.

3. Trap identification: each trap shall be tagged with a 1/2-inch stainless steel self-locking tag imprinted with an identification code.

4. Minimum commercial size = 5 inches CW, with a 0% tolerance. Exempt --soft shell crabs, or crabs held for bait and premolt crabs when held in a seperate container and not comprising more than 10% of the total catch.

5. Recreational fishermen may not use more than five traps.

6. Traps are prohibited within 100 yards of marked navigational channels.

7. Traps cannot be run between sunset and one half hour before sunrise.

8. Traps which are no longer servicable or in use shall be removed from the water.

9. Traps are prohibited north of a line established by the eastbound lane of Interstate 10, except for the portion of Interstate 10 lying north of Highway 90 where the line shall follow Highway 90.

10. No person may take crabs from traps belonging to another person without written authorization or to intentionally damage traps, floats, or buoys.

11. Licenses: commercial fishermen - crab catcher's license; other: seafood dealer license.

12. Reporting: monthly summaries (volume and value) at quartely intervals must be filed by wholesale crab dealers.

4.3.3 Mississippi

1. Buoy/line: no buoy may be attached with materials other than lines of nylon, hemp, cotton or woven synthetic materials which can easily be cut with a standard steel knife.

2. Trap identification: all commercial traps must be marked with the corresponding commercial crab license number in such a manner to be clearly visible to an inspecting officer, or a registered color code design on each buoy and painted or affixed to each side of the vessel; and,

each recreational trap shall be marked with the owner's name in such a manner to be clearly visible to an inspecting officer.

3. Minimum commercial size = 5 inches CW, with a 0% tolerance. Exempt -- peeler crabs and soft-shell crabs.

3. No ovigerous females may be kept from March 1 through June 30 of each year or from an area described as follows: "South of the Intracoastal Waterway, commencing at the Alabama-Mississippi boundary, and running west to the Gulfport Ship Island Channel."

4. Recreational fishermen may not use more than 16 traps.

5. No crabs may be harvested between January 1 and March 31 of each year, while trawling in a designated area in Mississippi Sound; to retain crabs, a trawler must have a crab catcher's license.

6. No crab traps or pots may be placed north of Interstate 10 in the three coastal counties.

7. No commercial crabbing is allowed in the Pascagoula River System north of the CSX railroad in Jackson County.

8. No crab trap or pot may be placed in any marked channel or fairway.

9. No crab trap may be placed or caused to be placed in any navigable waterway in such a manner that the trap line or float will interfere with normal boat traffic creating a hazard or nuisance to navigation.

10. Additional traps used by a licensed trap fishermen must be used soley within the crabbers' riparian rights and are attached to piers, pilings, or other permanent structures.

11. No one may remove crabs from crab traps that are not specifically licensed or permitted to said person, firm or corporation.

12. Licenses: commercial fishermen - boat, captain's, and crab license; other - interstate commerce and seafood dealer licenses; recreational fishermen - crabbing license, only if using more than six traps.

13. Crab dealer landings are obtained weekly.

4.3.4 Texas

1. Legal gear: crab line; crab trap; umbrella net (not exceeding 16 square feet); and, in other legal shrimp and fish operations.

2. Trap specification: maximum volume is 18 cubic feet; each trap must have at least two escape vents (minimum 2 3/8 inches inside diameter) in each crab-retaining chamber, and located on the lower edge of the outside trap walls; each trap must have an attached crab trap tag costing $1.50.

3. Buoy/line: Crab traps must have a white floating, visible buoy not less than six inches in width or height. Plastic bottles are not legal for trap buoys. Buoys must be marked with a dated tag, which must be replaced every 30 days.

4. Minimum commercial size = 5 inches CW, with a tolerance of not more than five percent by number of peeler crabs if placed in a separate container.

5. Crabs shall be separated by the catcher at the time taken, and all crabs less than the minimum size shall be returned to the waters from which taken.

6. Possession of ovigerous females prohibited. Removal of abdominal apron not allowed if taken from coastal waters.

7. No more than 200 crab traps may be used by a commercial fishermen.

8. Removal of traps from the water or removal of crabs from traps during the period from 30 minutes after sunset to 30 minutes before sunrise is prohibited.

9. Traps cannot be set less than 100 feet from another trap in public waters, except for traps attached to a pier or dock.

10. Crab traps may be used only in coastal waters.

11. In Aransas County, it is unlawful to place a crab trap within 200 feet of a marked navigable channel, or to place a crab trap in certain designated areas.

12. In Harris County waters north and west of State Highway 146 where it crosses the Houston Ship Channel, crabs may be taken by crab lines, hook and line, trotline and with no more than three crab traps.

13. In Brazoria County, it is unlawful to fish for crabs with more than three crab traps in that portion of the San Bernard River north of the boat ramp at Bernard Acres.

14. Licenses: commercial fishermen - commercial fisherman, boat, and crab trap licenses; other - wholesale dealer or transport licenses; recreational fishermen - sport license or saltwater sportfishing stamp.

15. Reporting: all seafood dealers who purchase directly from fishermen are required to file a monthly aquatic products report (volume and value) with the Department of Parks and Wildlife.

5.0 MANAGEMENT ISSUES

In this section problems and data needs are discussed and management recommendations are presented. While not all problems and data needs are prioritized, habitat and capture and harvest of suglegal crabs are the most critical issues. Efforts to maintain and enhance coastal habitats should be given the highest priority to help ensure the long-term viability of the blue crab resource. Management measures to reduce sublegal crab harvest should be addressed to increase yield per recruit in the fishery. Overcapitalization, user group conflicts, and trap and crab thefts are other obvious and conspicuous problems. Other problems and data needs are also discussed.

5.1 Habitat

Marsh loss, wetland impoundments, saltwater intrusion, and water quality degradation could have detrimental impacts on estuarine dependent species such as blue crab. Marsh loss is approximately 35 square miles annually (May and Britsch, 1987) and results from both natural and man-induced factors (Craig et al., 1980; Salinas et al., 1986). Salinity levels may have increased in coastal Louisiana in association with marsh loss. Approximately 30% of the total wetland area in the Louisiana coastal zone had been intentionally impounded before 1985 (Day et al., 1990), and with the interest in mariculture and increase in impounded marsh management units to combat coastal erosion, impoundment of marshes will probably accelerate in the future (Herke and Rogers, 1989). Agricultural and urban runoff from nonpoint sources may be laden with excessive nutrient loads.

Studies have found a significant relationship between production of blue crab (Orth and Montfrans, 1990) or other estuarine species (Turner, 1977 and 1979; Nixon, 1980; Deegan et al., 1986;) and total vegetated habitat among Gulf States. The impact of marsh loss on blue crab production may not be initially evident because biological productivity increases temporarily in deteriorating marshes (Gagliano and Van Beek, 1975), possibly due to an increase in shallow marsh-water interface habitat. However, biological productivity has been theorized to eventually decrease as the conversion of marsh habitats to open water continues and edge habitat in suitable salinity regimes declines below a "critical point." Browder et al. (1989) postulated that land-water interface in the Terrebonne-Barataria estuaries would begin to decline in the mid-1990's, after which brown shrimp (Penaeus aztecus) production would decline sharply. The response of blue crab populations to marsh loss may be similar to that proposed for brown shrimp. Long term trends in production, however, may be difficult to quantify because of interannual variability in landings associated with changes in fishing effort, climatic and hydrological factors, and other factors.

Marsh management with levees and weirs or other water control structures usually has short-term detrimental effects on estuarine dependent species such as blue crab because of interference with migratory cycles (Herke, 1968 and 1979; Rogers and Herke, 1985; Herke et al., 1987; Herke and Rogers, 1989).

The blue crab utilizes all salinity regimes of an estuary, with various life cycle stages occupying specific salinity regimes. Disruption of estuarine salinity gradients in association with physical habitat alterations could have adverse impacts on blue crabs. Low salinity marshes are important nursery habitat for juvenile blue crabs and increased salinity may reduce this critical habitat.

Water quality degradation may negatively impact blue crab in estuarine habitats and soft crab producers using open shedding systems. Excessive nutrient loading can result in accelerated eutrophication, leading to increased phytoplankton populations and turbidity levels and decreased oxygen levels. Caffey et al. (1993) noted that poor water quality greatly hampered soft crab shedders in Barataria/Lafitte and the north shore of Lake Pontchartrain near Slidell, where flow-through and float-car systems were still largely used.

Recommendation(s)/Option(s):

1. Coastal restoration projects that restore natural hydrological regimes and reduce and offset loss of estuarine habitats should be vigorously supported by governmental agencies, conservation groups, and the commercial fishing industry.

2. Efforts to reduce nonpoint pollution should be supported.

3. Pertinent research should be undertaken to determine the impact of marsh loss and estuarine hydrological alterations on blue crab recruitment and availability to the fishery (see Section 6.0).

5.2 Sublegal Crabs

For an 18-year period during the 1970's and 1980's, possession of sublegal crabs comprised 82.8% of crab citations by enforcement agents. The capture and subsequent sale of sublegal crabs has probably become more prevalent in recent years, and continues to be the most conspicuous enforcement problem in the crab industry. Increased sublegal crab catches in recent years may be attributed to: a) increased fishing effort leading to growth overfishing; b) expansion of fishing areas into freshwater and shallow marsh ponds where sublegal crabs dominate; c) adoption of traps constructed with 1.5-inch square mesh wire, which retains more sublegal crabs than the traditional hexagonal mesh wire traps; and, d) removal of liability to dealers and processors of sublegal crab violations due to a change in legislative statutes.

Concern over excessive catch of sublegal crabs is not related to stock-recruitment problems because blue crab stocks are not overfished in the "stock-recruitment" sense (Van Engel, 1987). However, excessive harvest of sublegal crabs will reduce yield (harvest weight) from the resource.

Recommendation(s)/Option(s):

The following management regulations are recommended to reduce sublegal crab catches in the commercial fishery.

1. Dual Liability. Current regulations mandate that commercial crab fishermen only are liable for sublegal crab violations. Dual liability for all involved parties (ie., fishermen, dealer, transporter, processor) for sublegal crab violations should be adopted. Dual penalties would provide incentive for fishermen to properly cull their catches and for dealers, processors, etc. to purchase crabs meeting minimum size constraints.

A disadvantage of dual liability is the difficulty of dealers and processors to closely inspect all crabs in every crate.

2. Sublegal Crab Exemption. Current language in 326(A) of Title 56 concerning the peeler crab exemption for sublegal crabs reads as follows: "... except when held for processing as soft crabs or sold to a processor for the making of crabs." The phrase should be changed to read: "... except pre-molt crabs held for soft crab production."

3. Recreational. A recreational possession limit should be considered to eliminate a loophole in enforcement of commercial minimum size regulations.

The following gear restrictions are options to reduce sublegal crab catches.

1. Escape Vents. Escape vents are rigid circular or square devices placed on the outside walls of a crab trap to allow sublegal crabs to escape that would otherwise be retained. Escape vents are currently mandatory in Texas, Florida, Georgia, Virginia, North Carolina, and Maryland. Steele and Perry (1990) also encouraged the use of escape vents.

Several studies have been conducted on escape vents and ghost fishing in crab traps that provide data and justifications for escape vent utilization (Eldridge et al., 1977; Whitaker, 1978 and 1980; Guillory, 1989, 1990, and 1993; Arcement and Guillory, 1993; Guillory and Merrell, 1993).

Escape vents are inexpensive and easily applied to traps. Each crab trap should have a minimum of three escape vents located on the outside walls of the upper or outer chamber flush with the floor or baffle. Circular vents should be a minimum of 2.375 inches in diameter while square vents should be a minimum of 2.0 inches per side. Escape vents should be rigid and attached to the trap with material not larger than the wire strands of the trap. Escape vent openings should not be obstructed with any material that prevents or hampers egress of crabs.

While sublegal crab catch may not be reduced below the legal allowance of 10% in areas where high densities (ie., 50-75% of total catch in traps without vents) occur, a reduction in sublegal crab catch of up to 75-80% can be expected when using escape vents. Reduction in

catch of sublegal crabs will result in several benefits.

a). There may be an immediate increase in catch rate of legal crabs. Overall catch in traps with escape vents will be lower than unvented traps; however, more legal crabs may be caught. Higher legal catches in traps with vents have been shown for blue crab (Eldridge et al., 1979; Whitaker, 1980; Guillory and Merrell, 1993), American lobster (Krouse and Thomas, 1975; Krouse, 1978; Fogarty and Borden, 1980), and western rock lobster (Bowen, 1963; Winstanley, 1973). Increased catch of legal crabs in traps is apparently due to a saturation effect that is not due to physical limitations of space but rather to behavioral interactions between crabs inside and outside of the trap (Guillory and Merrell, 1993); saturation has also been suggested by Fogarty and Borden (1980) for American lobster and Miller (1979) for two species of Cancer.

b). A delayed increase in catch rate of legal crabs may also occur because of decreased fishing and handling mortalities due to reduced harvest of sublegal crabs and delayed mortality associated with stress and injuries (see section c) on undersized crabs returned to the water. The release of sublegal crabs may result in increased numbers of legal crabs and increased weight of crabs per trap. Most sublegal crabs would be released and theoretically be available to the trap fishery at a larger size following their next molt. Blue crabs 4-5 inches in width will probably molt every 30-40 days (Tagatz, 1968) from spring through fall. A 4.5 inch blue crab weighing 88 grams (Guillory and Hein, 1995) increasing in width approximately 30% (Gray and Newcombe, 1938) would be approximately 5.8 inches in size and weigh 168 grams in the intermolt period following their next molt; the increase in weight would be approximately 70%.

c). Injuries or stress to undersized crabs that occur in the trap or during culling operations will be reduced if they are allowed to escape. Eldridge et al. (1979) found that 56.7% of all blue crabs caught in traps appeared to sustain damage. Besides direct mortalities, injuries and/or stress may affect future growth rates. Blue crabs increase in width by 1/4 to 1/3 their original size at each normal molt (Gray and Newcombe, 1938). Injuries, however, may reduce the percentage size increase at molting to 5-10%, and possibly no increase at all (Van Engel, 1958). Exposure to air during culling may stress sublegal crabs and result in delayed mortalities when returned to the water. Exposure times of 1/4 to 1/2 hour have resulted in spiny lobster and western rock lobster mortalities (Lyons and Kennedy, 1980; Brown and Caputi, 1983; Hunt et al., 1986).

d). Escape vents will reduce ghost fishing mortality in traps. Crab mortalities in unvented ghost traps averaged 25.8/trap for one year (Guillory, 1993) and 17.3/trap for three months (Arcement and Guillory, 1993). Mortality in unvented ghost traps was 3.2 times greater than in vented traps.

e). If culling/sorting time of the catch is related to the number of sublegal crabs present, then culling time of fishermen would be reduced substantially.

f). Law enforcement problems associated with possession of sublegal crabs will be

reduced, allowing additional time for other enforcement problems within the fishery.

g). Fewer sublegal crabs will be delivered to crab processors, who may not profitably process these small crabs.

The primary disadvantage of escape vents is an approximate 70% reduction in catches of pink-line and red-line crabs (Guillory, 1990). The primary source of premolt crabs for soft crab shedders is from hard crab trap fisherman. Reductions in premolt crab catches in traps with escape vents would adversely impact the soft crab industry as presently practiced; however, several options would ameliorate the negative impact on soft crab producers -- an exemption for peeler traps or seasonal blockage of escape vents to allow hard crab fishermen to catch peeler crabs as bycatch.

Peeler traps with one inch or less square or rectangular mesh used solely for the capture of premolt crabs for soft shell crab shedders should be exempt from escape vent mandates. Recent research (Prejean and Guillory, 1995) has shown that baited small mesh traps catch 4.5 to 5.5 times more premolt crabs than standard hexagonal mesh hard crab traps. Small mesh peeler traps could supply soft crab producers with adequate numbers of peeler crabs. This option is preferred; conservation agencies in Florida and several Atlantic states have excluded peeler traps from hard crab trap escape ring mandates.

Escape vents could be blocked during a six month period from March 15 to September 15. This six month period encompasses approximately 75% of the annual soft crab production.

2. Mesh Size. Minimum outside wall mesh sizes of 1.5 inches for hexagonal and greater than 1.5 inches for square mesh could be adopted for hard crab traps. In recent years 1.5 inch square mesh traps have become very common. Because 1.5 inch square mesh traps retain 1.9 times more sublegal crabs than traditional hexagonal mesh traps and two inch square mesh traps have lower catches of legal crabs (Guillory and Prejean, 1995), a minimum square mesh of larger than 1.5 inches but smaller than 2.0 inches would be optimum.

5.3 Overcapitalization

Overcapitalization in a fishery occurs when the level of fishing effort is greater than that needed to maximize industry profits. Total revenue in a fishery generally increases, but at a decreasing rate, with successive unit increases in effort. At some level of fishing effort, no further increase in revenue is realized. Consequently, profits per fisherman decrease in an overcapitalized fishery.

Profitable, open-access fisheries are susceptible to overcapitalization. The relatively low fixed investment requirements and resource abundance, coupled with several other economic and sociological factors, resulted in a dramatic increase in commercial blue crab fishing effort during the middle 1980's. Steele and Perry (1990) suggested that while gross income was relatively constant when evaluated on a deflated basis, profitability may be declining because of increased

costs such as increased number of traps per fishermen.

Recommendation(s)/Option(s):

The obvious solutions to excessive fishing effort are limited entry and/or trap limits. Trap limits would be extremely difficult to manage and enforce and was unsuccessful in the 1970's because of opposition from fishermen. Although limited entry is an abrupt, controversial change in the traditional "open access" commercial fisheries that are part of the cultural heritage in coastal Louisiana, a three year moratorium on commercial crab trap gear licenses was passed during the 1995 legislative session.

1. The effects of the license moratorium should be evaluated by monitoring trends in fishery dependent (ie., commercial catches and fishing effort) and fishery independent (ie., shrimp/groundfish trawl) data.

2. A system to track number of traps used per fishermen should be considered.

5.4 User Group Conflicts

One of the more volatile issues is the conflict between shrimp and crab fishermen over fishing grounds. Reports of friction and conflicts between these two commercial user groups have escalated in recent years. The increased number of both crab fishermen and number of traps per fisherman coupled with the tendency of crab fishermen to congregate traps in prime crabbing areas have resulted in some areas being difficult, if not impossible, to trawl. Ghost (ie., abandoned or lost) traps in such areas further aggravate the situation. Conversely, crab fishermen have seen increased numbers of traps lost or misplaced due to shrimp trawlers. In addition, conflicts may occur between commercial trap fishermen and waterfowl hunters, recreational fishermen, pleasure boat operators, recreational crabbers, and waterfront property owners.

Area and/or time restrictions for crab traps have been legislated for Sabine Lake (R.S.410.3), portions of Calcasieu River and Vermilion Bay [R.S. 332(J)], and the Tchefuncte River [R.S. 405(A)]. Areal exclusion of traps may only shift user-group conflicts elsewhere. In addition, restriction of crab traps in "navigable channels or entrances to streams" is too vague.

Recommendation(s)/Option(s):

Options to ameliorate the conflicts between commercial crab and shrimp fishermen revolve around separation of the two groups spatially or seasonally and restrictions on gear usage. Some specific measures might include elimination of night trawling and inside double rig trawlers, designation of commercial crabbing seasons, separation of shrimp and crabbing areas during periods of intensive fishing pressure, limited entry, trap limits, increasing distance between traps, and placing traps in a straight line. Most options are either impractical,

unenforceable, or not in the best interests of either fishery. However, conflict resolution meetings between user groups in impacted areas may prove beneficial and reduce the need for restrictive legislative statutes or commission regulations that may have negative impacts on one or both fisheries.

1. Area and time statutory restrictions on crab trap usage in specific localized geographical areas should be reviewed.

2. Crab traps should be prohibited in large, buoyed navigation or ship channels.

5.5 Trap and Crab Theft

Theft of traps or their contents has always been a problem in the fishery, but has escalated since the fishery began to expand dramatically during the middle 1980's. This has resulted in additional economic loss to the fisherman at a time when net profits may be declining.

Recommendation(s)/Option(s):

Trap and/or crab theft violations are difficult to enforce because visual verification is needed, often requiring a substantial investment of time. Manpower constraints and other enforcement responsibilities of the LDWF Enforcement Division render this problem difficult to resolve.

1. Communication and cooperation between and among local enforcement agents and crab fishermen would be beneficial.

2. A voluntary unique trap marking system among groups of commercial crabbers would assist in identifying stolen traps.

5.6 Ghost Fishing

Substantial numbers of crab traps are abandoned or lost due to uncontrollable factors (i.e., tides, currents, storm surges), simple negligence by the fishermen in properly assembling and maintaining attachment lines and floats, inadvertent clipping of float line by vessel propellers, and the use of plastic jugs or bottles as floats, which may become brittle with weathering and later crack and sink. Guillory (1993) and Arcement and Guillory (1994) found average mortality rates in ghost traps of 25.8 crabs/trap-year and 17.3 crabs/trap over a three month period. Any reduction in lost crab traps would benefit not only the fishermen but also the resource because of reduced ghost fishing mortality.

Recommendation(s)/Option(s):

1. Solid floats at least six inches in diameter and a nonmetallic nonfloating buoy line

should be mandatory to reduce the incidence of lost traps. Nonfloating lines would lessen the probability of inadvertent clipping by vessel propellers while solid floats would not sink after impacts or weathering.

2. Gear restrictions (ie., escape rings and minimal mesh size requirements) that reduce catch of sublegal crabs would likewise reduce ghost fishing mortality.

3. Degradable panels or tie-down straps would reduce long-term ghost fishing mortality in lost or abandoned traps.

5.7 Soft Crab Shedding/Premolt Crabs

Since the widespread adoption of closed, recirculating seawater systems reduced the problem of poor estuarine water quality in open, flow-through systems, the availability of premolt crabs has become the primary limiting factor in soft crab shedding operations (Perry et al., 1982). Fluctuations in premolt crab availability not only results in shedding systems often running at less-than-full capacity but also tempts shedders to overload closed systems when large quantities of premolt crabs become available (Caffey et al., 1993).

Recommendation(s)/Option(s):

1. To improve production in shedding facilities and to address the inadequate and inconsistent supply of premolt crabs, pertinent industrial/technological research should be completed (Section 6.0). Caffey et al. (1993) suggested that the problem of an inadequate and inconsistent premolt crab supply could be addressed by feeding hard crabs in captivity and by increasing the shock-loading capacity of closed, recirculating seawater systems.

5.8 Bait

Cost of bait is a major expense associated with crabbing. Roberts and Thompson (1982) estimated that bait costs comprised 34% of total costs. In addition, there may be shortages of quality bait during winter months. The quantity of natural bait used by fishermen also necessitates frequent trips to purchase bait.

Recommendation(s)/Option(s):

Development of an effective artificial crab bait would provide for a more consistent bait supply that may be stored without refrigeration.

5.9 Definition of Crab

Potential problems may arise because of several other issues. The definition of "crab" encompasses not only blue crab but also stone crabs. Regulations applicable to blue crab may not be appropriate for stone crabs. For instance, stone crabs have a smaller carapace width than

blue crabs and would not meet the five inch minimum size law.

Recommendation(s)/Option(s):

The definition of crabs should be redefined to exclude stone crab. This definition would leave an option for later regulations specific to stone crabs, if necessary.

6.0 RESEARCH NEEDS

Additional research that would fill some of the critical gaps in the blue crab life history and fishery are listed in Guillory et al. (1995). However, specific research projects that would provide data for management recommendations addressing some of the major problems and data gaps in the fishery or species biology are listed below:

1. Impact of altered salinity regimes on juvenile blue crab nursery grounds.

2. Impact of marsh loss and "marsh management" on blue crab populations.

3. Influence of environmental factors on blue crab recruitment.

4. Effects of predation on blue crab abundance.

5. Development of predictive models for blue crab landings and abundance.

6. Development of alternative methods or gears for harvesting premolt crabs.

7. Influence of trap mesh size on size distribution of catch.

8. Methodology to feed hard crabs held for shedding.

9. Methodology to increase the shock-loading capacity of closed shedding systems.

10. Methodology to induce molting in intermolt crabs.

11. Development of an artificial crab bait.

12. Influence of natural bait type and quantity and soak time on crab catches.

13. Development of predictive models for blue crab harvest or resource availability.

14. Effects of trap confinement and onboard culling on sublegal crab mortality and growth rates.

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